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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/550,689

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EXAMINER

MAI, ANH D

ART UNIT

PAPER NUMBER

2814

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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/550,689	<b>Applicant(s)</b> SHIBAYAMA, KATSUMI	
	<b>Examiner</b> Anh D. Mai	<b>Art Unit</b> 2814	

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 21 May 2009.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-14 is/are pending in the application.
- 4a) Of the above claim(s) 6-11 and 14 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-5, 12 and 13 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 21 July 2006 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \*    c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)            | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | Paper No(s)/Mail Date. _____                                      |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>7/21 and 9/26/2006; 4/25/2007; 1/24/2008</u> .                | 6) <input type="checkbox"/> Other: _____                          |



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## **DETAILED ACTION**

### ***Election/Restrictions***

1. Claims 6-11 and 14 have been withdrawn from further consideration pursuant to 37 CFR 1.142(b), as being drawn to a nonelected *invention and distinct species*, there being no allowable generic or linking claim. Applicant timely traversed the restriction (election) requirement in the reply filed on May 21, 2009.

2. Applicant's election of Group I, Species A, Claims 1-5, 12 and 13 as shown in Fig. 1, in the reply filed on May 21, 2009 is acknowledged. The traversal is on the ground(s) that claims 1, 4, 5, 12 and 13 are generic to both Species A and B. This is found persuasive.

However, the requirement is still deemed proper and is therefore made FINAL.

### ***Status of the Claims***

3. The Election filed May 21, 2009 is acknowledged. Invention Group I, Species A, Claims 1-5, 12 and 13 have been cancelled. Non-Elected Invention and Species B, Claims 6-11 and 14 have been withdrawn from consideration. Claims 1-14 are pending.

Action on merits of claims 1-5, 12 and 13 follows.

### ***Specification***

4. The lengthy specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

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5. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

The following title is suggested:

PHOTODIODE ARRAY AND RADIATION DETECTOR HAVING DEPRESSIONS OF PREDETERMINED DEPTH FORMED IN REGIONS CORRESPONDING TO THE REGIONS WHERE THE PHOTODIODES ARE FORMED IN THE SEMICONDUCTOR SUBSTRATE.

#### *Claim Objections*

6. Claims 3 is objected to because of the following informalities: the scope of claim 3 is the same as that of claim 2.

Claim3 recites: “the depression comprises **a plurality of depressions formed corresponding to the respective photodiodes.**

However, this limitation has been claimed in claim 1 as: wherein **a depression** with a predetermined depth more depressed than a region not corresponding to regions where the photodiodes are formed, **is formed in regions corresponding to the regions where the photodiodes are formed.**

Therefore, claims 2 and 3 are of the same scope.

Appropriate correction is required.

#### *Claim Rejections - 35 USC § 112*

The following is a quotation of the second paragraph of 35 U.S.C. 112:

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The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

7. Claims 2 and 3 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The scope of claim 3 is similar to that of claim 2.

Applicant is advised to cancel either claim for undue multiplicity. (See MPEP 2173.05 (n)).

### ***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

8. Claims 1-3 are rejected under 35 U.S.C. 102(b) as being anticipated by Ueda (JP. Patent No. 57-042175) of record.

With respect to claim 1, Ueda teaches a photodiode array as claimed including a semiconductor substrate (10),

wherein a plurality of photodiodes (11a-14a) are formed in array on an opposite surface side to an incident surface of light to be detected, in the semiconductor substrate (10), and

wherein a depression (31-34) with a predetermined depth more depressed than a region not corresponding to regions where the photodiodes (11a-14a) are formed, is formed in regions corresponding to the regions where the photodiodes (11a-14a) are formed, on a side of the incident surface of the light to be detected, in the semiconductor substrate (10). (See Fig. 2).

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With respect to claim 2, the depression (31-34) of Ueda comprises a plurality of depressions, and wherein adjacent depressions are in communication with each other.

With respect to claim 3, the depression (5) of Ueda comprises a plurality of depressions (31-34) formed corresponding to the respective photodiodes (11a-14a), and wherein adjacent depressions are in communication with each other.

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

9. Claims 4, 5 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ueda '175 as applied to claims 1 to 3 above, and further in view of Yoneta et al. (US Pub. No. 2003/0034496) of record.

With respect to claim 4, Ueda teaches the photodiode array as described in claim 1 above including a semiconductor substrate (10).

Thus, Ueda is shown to teach all the features of the claim with the exception of explicitly disclosing the semiconductor substrate is provided with an impurity region between the photodiodes adjacent to each other.

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However, Yoneta teaches a photodiode array including a semiconductor substrate (3), wherein the semiconductor substrate (3) is provided with an impurity region (6) between the photodiodes (4) adjacent to each other, for separating the photodiodes (4) from each other.

Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention was made to form the photodiode of Ueda to include the impurity region between the photodiode adjacent each other as taught by Yoneta to prevent cross-talk between the adjacent photodiodes.

With respect to claim 5, in view of Yoneta, the photodiode further includes a high-impurity-concentration layer (8) of the same conductivity type (N) as the semiconductor substrate (3) is formed on the incident surface side of the light to be detected, in the semiconductor substrate (3).

With respect to claim 12, in view of Yoneta, the device is a radiation detector comprising the photodiode array (1) and a scintillator panel (2) arranged opposite to the incident surface of the light to be detected in the photodiode array (1), and arranged to emit light with incidence of radiation. (See Fig. 1).

10. Claim 13 (and 13') is rejected under 35 U.S.C. 103(a) as being unpatentable over Yoneta '496 in view of Ueda '175.

With respect to claim 13, as set forth in claim 7, insofar as the device as concerned, Yoneta teaches a radiation detector substantially as claimed including:



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a photodiode array (1) comprising a semiconductor substrate (3) comprised a semiconductor of a first conductivity type;

a plurality diffused layer (4) of a second conductivity type on one surface of the semiconductor substrate (3) formed a plurality of photodiodes each comprises the impurity diffused layer (4) and the semiconductor substrate (3), in array; and

a scintillator panel (2) arranged opposite to the surface opposite in the photodiode array (1), and arranged to emit light with incidence of radiation. (See Fig. 1).

Thus, Yoneta is shown to teach all the features of the claim with the exception of explicitly disclosing the semiconductor substrate of the photodiode array having depressions.

However, Ueda teaches a photodiode array including:

depressions (31-34) with a predetermined depth more depressed than a region not corresponding to regions where the photodiodes (11a-14a) are formed, in region corresponding to the regions where the photodiodes (11a-14a) are formed, on another surface of the semiconductor substrate (10). (See Fig. 2).

Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention was made to form the photodiode array of Yoneta to include depressions formed in the semiconductor substrate as taught by Ueda to obtain a highly sensitive device, since the majority of the incoming rays are contributed to the signal.

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With respect to claim 13', as alternatively set forth in claim 8, insofar as the device as concerned, the photodiode array of Yoneta *as described in claim 13 above*, further comprising a high-impurity-concentration layer (8) of the first conductivity type (n) on the other surface of the semiconductor substrate (3).

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Anh D. Mai whose telephone number is (571) 272-1710. The examiner can normally be reached on 8:00AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on (571) 272-1705. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Anh D. Mai/  
Primary Examiner, Art Unit 2814

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